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04/27/00

jc760 U.S. PTO

UTILITY PATENT APPLICATION TRANSMITTAL LETTER

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
BO 42826

To the Assistant Commissioner for Patents:

Transmitted herewith for filing is the patent application of:

Johan Anton KOOIMAN

corresponding to Netherlands application 1014043, filed
January 7, 2000,

entitled: SUTURE EXPANSION DEVICE

jc530 U.S. PTO
09/559485
04/27/00

Enclosed are:

- | | |
|-------------------------------------|---|
| <input checked="" type="checkbox"/> | 10 pages of specification. |
| <input checked="" type="checkbox"/> | 2 sheets of formal drawings. |
| <input checked="" type="checkbox"/> | a newly-executed declaration of the inventor. |
| <input type="checkbox"/> | a copy of an executed declaration of the inventor from prior application
Serial No. , filed . |
| <input type="checkbox"/> | incorporation by reference. The entire disclosure of the prior application,
from which a copy of the oath or declaration is supplied as indicated in the
preceding box, is considered as being part of the disclosure of the accom-
panying application and is hereby incorporated by reference therein. |
| <input type="checkbox"/> | an assignment of the invention to , including assignment cover sheet. |
| <input type="checkbox"/> | Information Disclosure Statement with Form PTO-1449. |
| <input type="checkbox"/> | copies of the Information Disclosure Statement citations. |
| <input checked="" type="checkbox"/> | preliminary amendment. |
| <input checked="" type="checkbox"/> | return receipt postcard (MPEP 503), specifically itemized. |
| <input checked="" type="checkbox"/> | verified statements to establish small entity status under 37 CFR 1.9 and 1.27. |
| <input type="checkbox"/> | a verified statement to establish small entity status filed in prior application.
Status is still proper and desired. |
| <input type="checkbox"/> | a certified copy of the Priority Document. |
| <input checked="" type="checkbox"/> | other: application data sheet. |

If a CONTINUING APPLICATION, check appropriate box and supply the requisite information.

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP)

of prior application No. , filed .

- | | |
|-------------------------------------|---|
| <input checked="" type="checkbox"/> | Customer No. 000466. |
| <input checked="" type="checkbox"/> | Correspondence address is: YOUNG & THOMPSON, 745 South 23rd Street,
Second Floor, Arlington, Virginia 22202. |
| <input checked="" type="checkbox"/> | Telephone: (703) 521-2297. Telefax: (703) 685-0573 or (703) 979-4709. |

UTILITY PATENT APPLICATION TRANSMITTAL LETTER
(continued)

Docket No.
BO 42826

CLAIMS AS FILED

	NO. FILED	NO. EXTRA	RATE	FEE
BASIC FEE			\$ 690	\$ 690
TOTAL CLAIMS	15 - 20 =	0	X\$ 18	0
INDEPENDENT CLAIMS	1 - 3 =	0	X\$ 78	0
MULTIPLE DEPENDENT CLAIM PRESENT			\$ 260	

TOTAL \$

If applicant has small entity status under 37 CFR 1.9 and 1.27, then divide total fee by 2, and enter amount here.

**SMALL ENTITY
TOTAL**

\$ 345

- ☒ A check in the amount of \$345 to cover the filing fee is enclosed.
- ☒ The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to Deposit Account No. 25-0120 in the name of Young & Thompson, as described below. A duplicate copy of this sheet is enclosed.
- ☐ Charge the amount of \$ as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional fee required under 37 CFR 1.16 and 1.17, during the pendency of this application.
- ☐ Charge the issue fee set in 37 CFR 1.18 at the mailing of the Notice of Allowance.

Benoit Castel

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April 27, 2000

Form B

**VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) & 1.27(c))--SMALL BUSINESS CONCERN**

Docket Number (Optional)

Applicant or Patentee: Johan Anton KOOIMAN

Serial or Patent No.: _____

Filed or Issued: _____

Title: suture expansion device

I hereby declare that I am

- ☐ the owner of the small business concern identified below:
☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF SMALL BUSINESS CONCERN Van Straten Research & Development B.V.ADDRESS OF SMALL BUSINESS CONCERN P.O. Box 440, NL-3430 AKNIEUWEGEIN, The Netherlands

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.12, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees to the United States Patent and Trademark Office, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention described in:

- ☒ the specification filed herewith with title as listed above.
☐ the application identified above.
☐ the patent identified above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights in the invention must file separate verified statements averring to their status as small entities, and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d), or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization having any rights in the invention is listed below:

- ☒ no such person, concern, or organization exists.
☐ each such person, concern or organization is listed below.

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING J. VAN STRATEN (VAN STRATEN, Jaap)TITLE OF PERSON IF OTHER THAN OWNER DirectorADDRESS OF PERSON SIGNING EDISONBAAN 20, 3439 MN NIEUWEGEINSIGNATURE [Signature] DATE 20 April 2000

Form A

**VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) & 1.27(b))--INDEPENDENT INVENTOR**

Docket Number (Optional)

Applicant or Patentee: Johan Anton KOOIMAN

Serial or Patent No.: _____

Filed or Issued: _____

Title: SUTURE EXPANSION DEVICE

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

- ☒ the specification filed herewith with title as listed above.
☐ the application identified above.
☐ the patent identified above.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☐ No such person, concern, or organization exists.
☒ Each such person, concern or organization is listed below.

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P.O. Box 440, NL-3430 AK
Nieuwegein, The Netherlands

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF INVENTOR

Signature of inventor

Date

NAME OF INVENTOR

Signature of inventor

Date

KOOIMAN, Johan Anton
NAME OF INVENTOR

Signature of inventor

Date

20 April 2000

APPLICATION DATA SHEET

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APPLICATION INFORMATION

Title Line One:: SUTURE EXPANSION DEVICE
Total Drawing Sheets:: 2
Formal Drawings:: Y
Application Type:: UTILITY
Docket Number:: BO 42826

REPRESENTATIVE INFORMATION

Representative Customer Number:: 000466

PRIOR FOREIGN APPLICATION

Foreign Application One:: 1014043
Filing Date:: JANUARY 7, 2000
Country:: THE NETHERLANDS
Priority Claimed:: Y

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of
Johan Anton KOOIMAN
Serial No. (unknown)
Filed herewith
SUTURE EXPANSION DEVICE

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to calculation of the filing fee, please amend
the above-identified application as follows:

IN THE CLAIMS:

Claim 3, line 1, cancel "or 2".

Claim 6, line 1, change "one of the preceding
claims" to --Claim 1--.

Claim 7, line 1, change "one of the preceding
claims" to --Claim 1--.

Claim 8, line 1, change "one of the preceding
claims" to --Claim 1--.

Claim 9, line 1, change "one of the preceding
claims" to --Claim 1--.

Claim 11, line 1, cancel "9 or".

Claim 13, line 1, cancel "and 10".

Johan Anton KOOIMAN

Claim 14, line 1, change "one of the preceding
claims" to --Claim 1--.

Respectfully submitted,

YOUNG & THOMPSON

By



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April 27, 2000

Suture expansion device

The present invention relates to a suture expansion device comprising:

- a central stretching screw support;
- 5 - on either side of the stretching screw support, a right and a left fixing means support for fixing to the right and, respectively, the left section of the superior dental arch;
- two stretching screws, which are parallel to one another, extend between the fixing means supports and are accommodated in screw passages made in the stretching screw support and threaded to match the relevant stretching screw;
- 10 wherein the stretching screws can be screwed in mutually opposed longitudinal directions out of the stretching screw support in order to push the right-hand and left-hand fixing means supports apart.

In the specialist field suture expansion is also referred to as 'maxillary expansion' or 'palatal expansion', both of which terms are frequently prefixed by 'rapid'.

- 15 A suture expansion device of this type is disclosed in WO 94/26196. The suture expansion device known from this publication consists of a stretching screw support in the form of a cylindrical sleeve which is provided over virtually its entire length with a bore of large diameter provided with an internal thread and is provided at one end with a partition with a bore of small diameter, provided with an internal thread, therein. At one side a pin
- 20 provided with an external thread extends from the outside through the small bore, which pin forms a first stretching screw, and at the other side a hollow pin with an external thread is screwed in from the outside, which hollow pin forms the second stretching screw. The cavity in the hollow pin is such that the first stretching screw fits in said cavity as it were in a telescopic manner. In the fully screwed-in position the first stretching screw and the second
- 25 stretching screw are inserted one inside the other virtually completely in the sleeve-shaped stretching screw support. If the sleeve-shaped stretching screw support is now turned the stretching screws move outwards in opposing directions at either end as a result of their opposing threads. At their ends pointing away from the sleeve-shaped stretching screw support the stretching screws have fixing means supports in the form of U-shaped wires. The
- 30 expansion length achievable with this suture expansion device is of the order of magnitude of 1.5 times the length of the suture expansion device in the fully screwed-in position. A significant disadvantage of this known suture expansion device is, however, that this device is insufficiently stable and rigid. Consequently, the jaws, or, more accurately, the right and the

left portion of the superior dental arch, can also be pushed skew as well as, as intended, pushed apart. A further problem is that insofar as the device according to WO 94/26196 does have some rigidity and stability, this is provided only by the stretching screws, which has the associated risk of jamming.

5 The aim of the present invention is to provide a suture expansion device of the type with which the maximum expansion stroke has a length of the order of magnitude of approximately 1.5 (or possibly more) times the length of the suture expansion device measured in the expansion direction when the device is in the fully retracted position, which device is of particularly stable and rigid construction and is reliable in operation.

10 Said aim is achieved according to the invention in that for each fixing means support a guide system is provided that prevents rotation of the relevant fixing means support relative to the stretching screw support and guides movement of the fixing means support in the longitudinal direction of the stretching screw. The guide system provides the construction of the suture expansion device with rigidity and stability. The guide system ensures that while
15 the fixing means supports are movable relative to the stretching screw support in the longitudinal direction of the stretching screws they in other respects remain fixed with respect to the stretching screw support.

Because two stretching screws which are effective in opposing directions are used, a relatively large expansion stroke can be achieved which will be in the order of magnitude of
20 the sum of the lengths of the stretching screws.

To make the suture expansion device expand, the one stretching screw and the other stretching screw can be turned alternately, but it is also possible to unscrew first one stretching screw to its full extent and then the other stretching screw. In practice, incidentally, the expansion will take place gradually in the sense that the expansion increases by a
25 predetermined extent per predetermined unit time. In this context it is possible, for example, to conceive an increase in the expansion of approximately 0.6 mm per day, an expansion step of approximately 0.2 mm, which can be achieved by, for example, unscrewing each expansion screw by 0.1 mm, being made in the morning, at midday and in the evening. If the screw threads are suitably chosen each screw can move out 0.1 mm on turning through 90°.

30 According to a preferred embodiment of the invention the stretching screws are freely rotatable about their longitudinal axes relative to the fixing means supports. By allowing the stretching screws to bear freely on the fixing means supports or at least keeping them freely rotatable about their own longitudinal axis relative to the fixing means supports, no moment

will be exerted on the fixing means supports by turning the stretching screws and said fixing means supports will only be pushed outwards or, on screwing in, be able to move inwards, at least provided they are not restrained.

Although the guide system according to the invention can be implemented in a variety of ways, from the constructional, cost and reliability standpoint it is preferable if each guide system comprises at least one guide rod which is fixed by one end to the relevant fixing means support and which is accommodated in a guide passage in the stretching screw support such that it is slidable in the longitudinal direction. Such a guide system is compact and simple to produce.

With a view to, in particular, a robust, stable and rigid suture expansion device it is preferable according to the invention if each guide system comprises two of said guide rods, which are positioned some distance apart in a longitudinal direction running transversely to the left/right direction, and the stretching screws, viewed in said longitudinal direction, are located between the two guide rods. With this arrangement the guide rods provide the mutual stability and rigidity between the fixing means supports and the stretching screw support, whilst the stretching screws themselves are subjected to no or hardly any stress other than pressure, as a result of which, inter alia, jamming is largely prevented. Moreover, by positioning the stretching screws between the two guide rods it is possible largely to counteract the guide rods being able to jam in their guide passages in the stretching screw support as a consequence of forces acting transversely to the guide direction.

According to an advantageous embodiment, with this arrangement said longitudinal direction will run essentially parallel to the patient's palate when the suture expansion device is in the use position.

In order to obtain a suture expansion device which is as compact as possible in the fully retracted position and has as large as possible an expansion stroke in the fully expanded position, it is advantageous according to the invention if the stretching screws and guide systems extend from the right-hand to the left-hand fixing means support when the suture expansion device is in the retracted position. In order further to increase the compactness it is furthermore advantageous with this arrangement if the guide rod or guide rods and stretching screw belonging to the right-hand and left-hand fixing means support respectively extend with their left-hand or right-hand end respectively into, or even through, the left-hand or right-hand fixing means support, respectively, when the device is in said position.

To prevent the suture expansion device being screwed too far apart it is advantageous

according to the invention if, per fixing means support, a travel limiter prevents a predetermined maximum distance between the fixing means support concerned and the stretching screw support being exceeded. Otherwise it would be possible for a fixing means support to become completely detached from the stretching screw support, which would
5 render the suture expansion device ineffective in its entirety and would give rise both to a great deal of discomfort for the patient and considerable work for the specialist treating the patient.

In order to be able to turn the stretching screws it is advantageous according to the invention if each stretching screw is provided with engagement means on which the tool is
10 able to engage for turning the stretching screw concerned. According to an advantageous embodiment, the engagement means can comprise holes distributed around the circumference of the stretching screw, which holes are positioned preferably 90° or at most 90° apart. In this way an element suitable for the purpose can in each case be inserted in a hole and the stretching screw can then be turned a quarter turn so as to be able to insert the element
15 concerned in the next hole. Because the engagement means are readily accessible at all times for engaging a tool therein it is advantageous according to the invention if the engagement means are provided at that end of the stretching screw concerned which faces in the unscrewing direction. With a view to the greatest possible compactness when the suture expansion device is in the fully retracted position it is preferable if the ends of the respective
20 stretching screws provided with engagement means are recessed in an indent open at the bottom in the respective fixing means support on which the respective stretching screw acts during expansion. So as to be able to ensure expansion by an accurately predetermined value per turning stroke of a stretching screw with this arrangement, it is advantageous according to the invention if each indent open at the bottom is provided with sloping guide surfaces on
25 either side, which guide surfaces enclose an angle equal to the angular distance between the holes and have an imaginary point of intersection above the holes, such that a rod- or pin-shaped tool can be inserted over the one guide surface into one of the holes. In this context top and bottom are related to the position when placed in the mouth. If the guide surfaces and holes are, for example, 90° apart and the stretching screw is turned such that two of the holes
30 are located in the extension of the guide surfaces, a pin can be inserted over one of the guide surfaces into a hole and turned through 90° until it comes into contact with the other guide surface, which with this arrangement actually acts only as a stop face. During said turning the next hole comes into line with the one of the guide surfaces.

The present invention will be explained in more detail below with reference to two illustrative embodiments shown diagrammatically. In the drawing:

Fig. 1 shows a diagrammatic perspective view of a model of an upper jaw in which a suture expansion device according to a first illustrative embodiment of the invention has been placed;

Figs 2a, 2b and 2c show, respectively, a right-hand side view, a plan view and a left-hand side view of the suture expansion device according to Fig. 1, the plan view, which is shown partially in section, being in an expanded position but not yet in the maximum expanded position;

Fig. 3 shows a plan view of the suture expansion device according to Figs 1 and 2 in the fully retracted position;

Fig. 4 shows a suture expansion device according to a second illustrative embodiment of the invention; in plan view, partial cross-section and not yet fully expanded position; and

Fig. 5 shows a detailed cross-sectional view, corresponding to V - V in Figure 4, of the inside of a fixing means support at the location of the indent for accommodating the operating end of a stretching screw.

In Fig. 1 a model of the upper teeth is indicated by 1. A suture expansion device 10 according to the invention has been placed in this model, which suture expansion device 10 is attached by means of wires 4 and bands, which are not shown, at either side to a molar 2 and a premolar 3. It will be clear that it is also possible to make use of the rear molars 5 and/or rear premolars 6 instead of the front molars 2 and/or front premolars 3 for attaching the suture expansion device 10. By expanding the suture expansion device 10 in the left/right direction (double headed arrow E), the upper set of teeth can be spread, during which operation in general the so-called suture 7 will open.

With reference in particular to Figs 2 and 3, but also to Fig. 1, the suture expansion device 10 according to the first illustrative embodiment consists of a central stretching screw support 11 with, on either side, a left-hand fixing means support 12 and right-hand fixing means support 13. The suture expansion device 10 also comprises two stretching screws 14 and 15 which are parallel to one another, extend between the fixing means supports 12 and 13 and are each accommodated in a screw passage 21 made in the stretching screw support 11. Threading matching the thread of the stretching screws 14 and 15 is provided in said screw passage 21. Furthermore, a guide system 17, 19 and 16, 18, respectively, is provided per fixing means support 12, 13, which guide system prevents rotation of the fixing means

support 12 or 13, respectively, relative to the stretching screw support 11 but allows movement of the respective fixing means support 12 or 13 in the longitudinal direction of the stretching screws 14, 15.

Each guide system consists of two guide rods 17, 19 and 16, 18, respectively, which are
5 fixed by their one end to the fixing means support 12 or 13, respectively, and by their other end are slidably accommodated in a guide passage 22 formed in the stretching screw support 11.

So that it is possible to turn the stretching screws 14 and 15 it is important that these screws are not joined to the fixing means supports 13 and 12, respectively, such that they are
10 unable to rotate. In the embodiment according to Figs 1, 2 and 3 the stretching screw 14 or 15, respectively, is not joined to the fixing means support 13 or 12, respectively, at all other than by bearing on said support under the influence of pressure.

The stretching screws 14 and 15 can be turned by placing a suitable tool in the holes 20 positioned 90° apart in the circumferential direction. As a consequence of the guide systems
15 17, 19 and 16, 18, hardly any moment will be exerted on the fixing means supports 12 and 13 on turning the stretching screws 14 and 15. The guide systems 17, 19, 16 and 18 also ensure, and this is very important, that the movement of the fixing means supports 12, 13 relative to the stretching screw support 11 is an essentially purely translational movement. In this way it is ensured that the front fixing points (the premolars 3 in Fig. 1) and the rear fixing points (the
20 molars 2 in Fig. 1) are stressed to an equal extent during expansion.

The expanded position shown in particular in Fig. 2b is not the maximum expanded position. This maximum expanded position is achieved when the stretching screws 14 and 15 are unscrewed even further until they come completely free or virtually completely free from their passages 21. Preferably, the stretching screws 14 and 15 will still extend approximately
25 1 to 2 mm into the stretching screw support 11 in the maximum expansion position. In order to fix the maximum position and to prevent the screws coming out of the stretching screw support 11 completely, travel safety features can be provided on the stretching screws 14 and 15 or optionally on the guide systems 17, 19 and 16, 18. As far as, for example, the stretching screws 14 and 15 are concerned, such a travel safety feature can be obtained by providing
30 only the starting section of the stretching screw passages 21 with internal screw thread and providing the free ends of the stretching screws 14 and 15 with, for example, a burr. As far as stretching screw passage 21 for stretching screw 14 is concerned, the first 1 to 2 mm, for example, of that end thereof facing towards the fixing means support 13 is provided with an

internal screw thread and that end of the stretching screw 14 which faces towards the fixing means support 12 is provided with a burr. The maximum achievable expansion stroke is then, in particular, determined by, on the one hand, the length of the stretching screws 14 and 15 and, on the other hand, the width of the stretching screw support 11 measured in the longitudinal direction of the stretching screws 14 and 15. With this arrangement, the length of the stretching screws can, for example, be optimised by countersinking the free ends, that is to say the ends thereof which face away from the fixing means support with which the stretching screw concerned interacts, in the other fixing means support or by allowing them to extend through the latter, as can be seen in Fig. 3.

Fig. 4 shows a second illustrative embodiment of a suture expansion device according to the invention in the expanded position but not yet in the maximum expanded position. The suture expansion device shown in Fig. 4 is, in particular, further optimised with regard to, on the one hand, the maximum achievable expansion stroke and, on the other hand, the compactness in the fully retracted position.

Since the suture expansion device according to Fig. 4 in broad lines corresponds to that according to Fig. 1 - 3, corresponding parts have been provided with corresponding reference numerals.

The fixing means supports 12 and 13 are each provided with a recess 25 in which the active head 29 of the respective stretching screw 14 or 15 can be accommodated. The head 29 of the respective stretching screw 14 or 15 is provided with holes 20, positioned 90° apart in the circumferential direction, in which a tool can engage. The recesses 25 are open not only in the direction of the stretching screw support 11 but also in the downward and/or upward direction, that is to say in the one or the other direction perpendicular to the plane of the drawing according to Fig. 4. The reason for this is to keep the heads 29 of the stretching screws accessible to the tool. Accommodating the heads 29 of the stretching screws in the recesses 25 makes it possible to allow the inner surfaces 30 of fixing means supports 12 and 13 to bear against the outer surfaces 31 of the stretching screw support 11 on either side without any gap between them when the stretching screws are in the fully retracted position. This is highly beneficial for the compactness in the fully retracted position. The lengths of the stretching screws and guide rods are chosen such that the free ends thereof, or at least the ends thereof, which face away from the fixing means support with which the stretching screw or guide rod interacts are, in the fully retracted position, flush with the outer surface 28 of the respective stretching screw support 12 or 13 with which they do not interact or optionally

even protrude through said outer surface 28 with some protrusion length. It should be clear that the effective lengths of the stretching screws 14 and 15, on the one hand, and the effective lengths of the guide rods 16, 18, 17 and 19, on the other hand, will be essentially equal, at least in the case of optimisation of, on the one hand, the compactness in the fully retracted position and, on the other hand, the maximum expansion stroke.

By providing a guide bush 26 on the stretching screw support 11 per guide rod 16, 17, 18, 19, which guide bush extends the guide passage 22 in the direction of the fixing means support 12 or 13 to which the respective guide rod is fixed, and providing the respective fixing means support 12 or 13, opposite the respective guide bushes 26, with a widening 27 around the respective guide rod, in which widening the guide bush 26 can be completely accommodated, the maximum expansion stroke can be further increased for the same minimum length, viewed in the expansion direction in the fully retracted position. The guide bushes 26 make it possible to unscrew the stretching screws 14 and 15 completely or virtually completely from the stretching screw support 11. In this way the maximum achievable expansion stroke comes close to the sum of the lengths of expansion screws 14 and 15. Apart from increasing the maximum expansion stroke, the guide bushes 26 also contribute to the stability of the guide systems by extending the length of the guide passages 22.

To illustrate, on the one hand, the compactness in the fully retracted position and, on the other hand, the maximum expansion stroke in the fully expanded position, two examples are given below with reference to Fig. 4:

Fig. 5 is a cross-section corresponding to V - V in Figure 4 and shows a cross-sectional detailed view of the inside of the fixing means support 12 at the location of the recess or indent 25 for accommodating the operating end 29 or head 29 of the stretching screw 15. The recess 25 is provided on either side with a sloping guide surface 40 and 41, respectively. Said guide surfaces 40, 41 enclose an angle of 90° between them, corresponding to the angular spacing between the holes 20 in the head 29 of the stretching screw. If a pin-shaped tool, indicated by 42, is now inserted over guide surface 40 into hole 20 and this tool is then turned in accordance with arrow P through 90° until it comes into contact with the other guide surface 41, then, on the one hand, angular rotation through the angle enclosed by the guide surfaces is reliably ensured and, on the other hand, it is ensured that the next hole is in line with the one guide surface 40 so as to be readily accessible to the tool 42 on the next rotational stroke. The recess or indent for the head 29 of the other stretching screw 14 is made in a corresponding manner.

Example 1:

- Thickness D of the fixing means supports 12 and 13 is: 2 mm;
Width B of the stretching screw support 11 is: 6 mm;
Length of stretching screws 14 and 15 and guide rods 16, 17, 18 and 19 is: 8 mm,
5 which length is measured from the inner surface 30 of the fixing means support to which the screws are effectively joined.
In the fully retracted position the length A is then $B + 2D = 10$ mm.
Assuming that the free ends of the stretching screws 14 and 15 remain screwed 1 to 2 mm into the stretching screw support 11, for example in the case of the absence of the
10 guide bushes 26, the length A in the case of full expansion is:
$$A = 2 \times D + B + 2 \times (\text{screw length} - 1 \text{ to } 2 \text{ mm}) = 22 \text{ to } 24 \text{ mm.}$$

The so-called expansion stroke is then 12 to 14 mm.

Example 2:

- 15 Thickness D of the fixing means supports 12 and 13 is: 2 mm;
Width B of the stretching screw support 11 is: 6 mm;
Length of stretching screws 14 and 15 and guide rods 16, 17, 18 and 19 is: 8 mm,
which length is measured from the inner surface 30 of the fixing means support to which the screws are effectively joined.
20 Length L of the guide bushes 26 is 1 mm.
In the fully retracted position the length A is then $B + 2D = 10$ mm.
On completely unscrewing the stretching screws 14 and 15 from the stretching screw support 11, the length A in the fully expanded position is then:
$$A = 2 \times D + 2 \times \text{screw length} = 26 \text{ mm.}$$

25 The maximum expansion stroke is then 16 mm. The maximum expansion stroke then has a length of 1.6 times the length of the suture expansion device in the fully retracted position measured in the expansion direction.

- 30 Although based on preferred illustrative embodiments, the examples given above are purely illustrative.

It should be clear that the dimensions cited can be varied depending on the circumstances. It is, for example, not only conceivable, but also possible, to increase the length A in the fully expanded position by reducing the thicknesses D and increasing the

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width B, for the same A in the fully retracted position. It is also possible, as will be immediately apparent, to increase the length A at maximum expansion and at the same time to increase the length A in the fully retracted position. With a view to unambiguity in operation of the stretching screws 14 and 15 it is preferable to provide these with mutually
5 opposing thread.

CLAIMS

1. Suture expansion device comprising:

- a central stretching screw support;
- 5 - on either side of the stretching screw support, a right and a left fixing means support for fixing to the right and, respectively, the left section of the superior dental arch;
- two stretching screws, which are parallel to one another, extend between the fixing means supports and are accommodated in screw passages made in the stretching screw support and threaded to match the relevant stretching screw;
- 10 wherein the stretching screws can be screwed in mutually opposed longitudinal directions out of the stretching screw support in order to push the right-hand and left-hand fixing means supports apart; and

wherein for each fixing means support a guide system is provided that prevents rotation of the relevant fixing means support relative to the stretching screw support and
15 guides movement of the fixing means support in the longitudinal direction of the stretching screw.

2. Suture expansion device according to Claim 1, wherein the stretching screws are freely rotatable about their axes relative to the fixing means supports.

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3. Suture expansion device according to Claim 1 or 2, wherein each guide system comprises at least one guide rod which is fixed by one end to the relevant fixing means support and which is accommodated in a guide passage in the stretching screw support such that it is slidable in the longitudinal direction.

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4. Suture expansion device according to Claim 3, wherein each guide system comprises two of said guide rods, which are positioned some distance apart in a longitudinal direction running transversely to the left/right direction, and wherein the stretching screws, viewed in said longitudinal direction, are located between the two guide
30 rods.

5. Suture expansion device according to Claim 4, wherein said longitudinal direction runs essentially parallel to the patient's palate when the suture expansion device is in the

use position.

6. Suture expansion device according to one of the preceding claims, wherein the stretching screws and guide systems all have essentially the same length.

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7. Suture expansion device according to one of the preceding claims, wherein the stretching screws and guide systems extend from the right-hand to the left-hand fixing means support when the suture expansion device is in the retracted position.

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8. Suture expansion device according to one of the preceding claims, comprising, per fixing means support, a travel limiter which prevents a predetermined maximum distance between the fixing means support concerned and the stretching screw support being exceeded.

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9. Suture expansion device according to one of the preceding claims, wherein each stretching screw is provided with engagement means on which a tool is able to engage for turning the stretching screw concerned.

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10. Suture expansion device according to Claim 9, wherein the engagement means comprise holes distributed around the circumference of the stretching screw, which holes are positioned preferably 90° or at most 90° apart.

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11. Suture expansion device according to Claim 9 or 10, wherein the engagement means are provided at that end of the stretching screw concerned which faces in the unscrewing direction.

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12. Suture expansion device according to Claim 11, wherein the end of each stretching screw provided with engagement means is recessed in an indent open at the bottom in the respective fixing means support on which the stretching screw acts during expansion.

13. Suture expansion device according to Claim 12 and 10, wherein the indent open at the bottom is provided with sloping guide surfaces on either side, which guide surfaces

enclose an angle equal to the angular distance between the holes and have an imaginary point of intersection above the holes, such that a rod- or pin-shaped tool can be inserted over the one guide surface into one of the holes.

- 5 14. Suture expansion device according to one of the preceding claims, wherein a guide bush is provided in the extension of each guide rod passage, at the end thereof that faces towards the fixing means support to which the respective guide rod is fixed.

- 10 15. Suture expansion device according to Claim 14, wherein the respective fixing means support is provided, around said respective guide rod, opposite the guide bush, with a widening in which the guide bush can be accommodated and preferably can be accommodated in its entirety.

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ABSTRACT

The invention relates to a suture expansion device. The suture expansion device comprises a central stretching screw support; on either side of the stretching screw support, a right and a left fixing means support for fixing to the right and, respectively, the left section of the jaw; and two stretching screws which are parallel to one another extending between the fixing means supports and accommodated in screw passages made in the stretching screw support and threaded to match the relevant stretching screw. The stretching screws can be screwed outwards in mutually opposed directions out of the stretching screw support in order to push the right-hand and left-hand fixing means supports apart. For each fixing means support a guide system is provided that prevents rotation of the relevant fixing means support relative to the stretching screw support and guides movement of the fixing means support in the longitudinal direction of the stretching screw. The stretching screws are freely rotatable about their longitudinal axes relative to the fixing means supports.

fig - 1

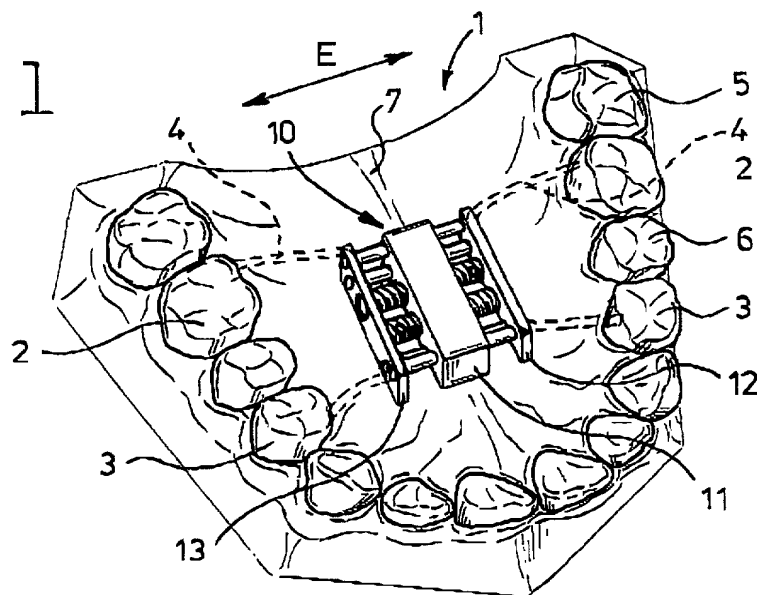


fig - 2a

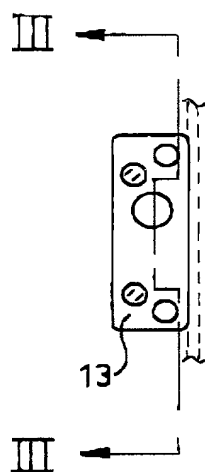


fig - 2b

fig - 2c

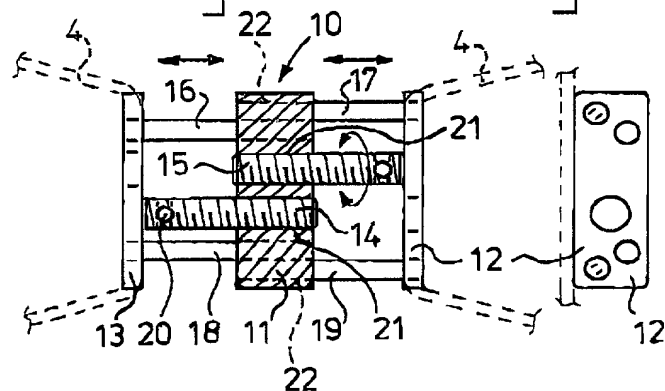


fig - 3

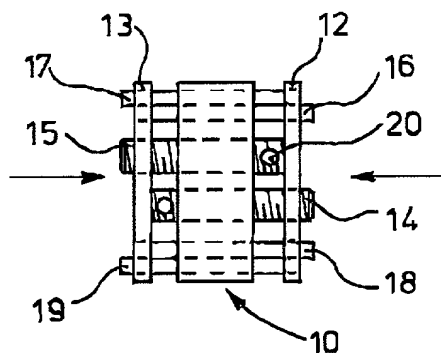


fig-4

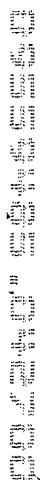
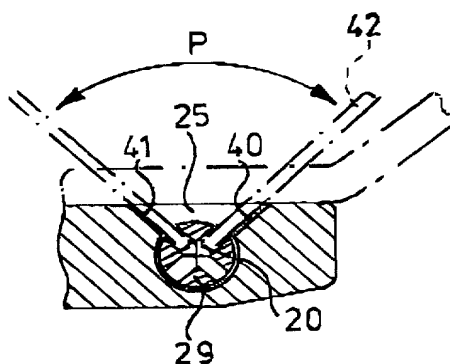


fig-5



975,6

COMBINED DECLARATION AND POWER OF ATTORNEY**(ORIGINAL DESIGN, NATIONAL STAGE OF PCT OR CIP APPLICATION)**

As a below named inventor, I hereby declare that

My residence, post office address and citizenship are as stated below next to my name, I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Suture expansion device

the specification of which: (complete (a), (b) or (c) for type of application)

REGULAR OR DESIGN APPLICATION

- a. ☐ is attached hereto.
b. ☐ was filed on _____ as Application
Serial No. _____ and was amended on _____
(if applicable)

PCT FILED APPLICATION ENTERING NATIONAL STAGE

- c. ☐ was described and claimed in International application No. _____
filed on _____
and as amended on _____ (if any)

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, paragraph 1.56(a).

In compliance with this duty there is attached an information
disclosure statement 37 CFR 1.97

PRIORITY CLAIM

I hereby claim foreign priority benefits under Title 35, United States Code paragraph 119 of any foreign application (s) for patent of inventor's certificate listed below and have also identified below any foreign application for patent of inventor's certificate having a filing date before that of the application on which priority is claimed.

(complete (d) or (e))

- d. ☐ no such applications have been filed
 e. ☒ such applications have been filed as follows

**EARLIEST FOREIGN APPLICATION(S), IF ANY FILED WITHIN 12 MONTHS
 (6 MONTHS FOR DESIGN) PRIOR TO SAID APPLICATION**

Country	Application Number	Date of filing (day, month, year)	Date of Issue (day, month, year)	Priority claimed
The Netherlands	1014043	7 January 2000		Yes

**ALL FOREIGN APPLICATION(S), IF ANY FILED MORE THAN 12 MONTHS
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CONTINUATION-IN-PART

(Complete this part only if this is a continuation-in-part application)

I hereby declare claim the benefit under Title 35, United States code, paragraph 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claim of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, paragraph 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, paragraph 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.) (Filing date) (Status) (patented, pending, abandoned)

(Application Serial No.) (Filing date) (Status) (patented, pending, abandoned)

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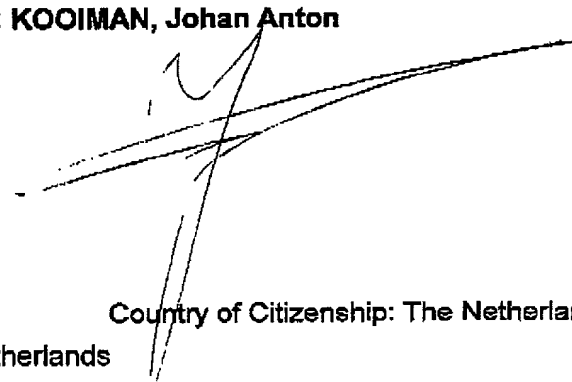
As a named inventor, I hereby appoint the following attorney(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: Robert J. PATCH, Reg. No. 17,355, Andrew J. PATCH, Reg. No. 32,925, Robert F. HARGEST, Reg. No. 25,590, Benoît CASTEL, Reg. No. 35,041, Eric Jensen, Reg. No. 37,855, and Thomas W. PERKINS, Reg. No. 33,027 c/o YOUNG & THOMPSON, Second Floor, 745 South 23rd Street, Arlington, Virginia 22202.

Address all telephone calls to Young & Thompson at 703/521-2297,

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code and that such wilful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor: **KOOIMAN, Johan Anton**

Inventor's signature



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